

METRIC

MIL-DTL-512C  
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SUPERSEDING  
MIL-DTL-512B  
6 July 1998

## DETAIL SPECIFICATION

### ALUMINUM POWDER, FLAKED, GRAINED, AND ATOMIZED

This specification is approved for use by all departments and agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers aluminum powder for use in pyrotechnics, incendiaries, propellants, and explosives.

1.2 Classification. The aluminum powder types, grades, and classes should be as listed in table I (see 6.3).

TABLE I. Classification.

Type	Grade	Class
Type I - flaked	A	1
	B	2
	B	2A
	B	3
Type II - grained or atomized	C	4
	C	4A
	D	5
	D	5A
	E	6
Type III - atomized	F	6
	F	7
	F	8

Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this document should be addressed to: Defense Supply Center Richmond (DSCR), ATTN: DSCR-VBD, 8000 Jefferson Davis Highway, Richmond, VA 23297-5610 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 6810

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

### 2.2 Government documents.

2.2.1 Standards. The following standard forms a part of this document to the extent specified herein. Unless otherwise specified, the issue is that listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplemented thereto, cited in the solicitation (see 6.3).

#### STANDARD

##### FEDERAL

FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities.

(Unless otherwise indicated, copies of the above standard are available from the Standardization Documents Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094. Electronic copies of federal specifications are available from <http://astimage.daps.dla.mil/quicksearch/>.)

2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of documents that are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of the documents not listed in the DoDISS are the issues of documents cited in the solicitation (see 6.3).

#### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 214	- Standard Test Method for Sieve Analysis of Metal Powders (DoD adopted).
ASTM B 329	- Standard Test Method for Apparent Density of Metal Powders and Compounds Using the Scott Volumeter (DoD adopted).
ASTM B 417	- Standard Test Method for Apparent Density of Non-Free-Flowing Metal Powders Using the Carney Funnel.
ASTM D 480	- Standard Test Methods for Sampling and Testing of Flaked Aluminum Powders and Pastes (DoD adopted).
ASTM E 11	- Standard Specification for Wire Cloth and Sieves for Testing Purposes (DoD adopted).

ASTM E 34 - Standard Test Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys (DoD adopted).

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Electronic copies of ASTM documents are available from <http://www.astm.org/>.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

3.1 Material. Aluminum powder shall be manufactured from aluminum metal of such purity that the product meets the requirements of table II.

TABLE II. Chemical characteristics.

Requirement <sup>1</sup> , weight %	Grade A	Grade B	Grade C	Grade D	Grade E	Grade F	Test method
Al, min.	98.0	98.0	99.0	99.0	99.0	99.0	4.4.2.2
Cu, max.	0.50	0.50	0.50	0.50	0.50	0.50	4.4.2.2
Fe, max.	0.50	0.50	0.50	0.50	0.50	0.50	4.4.2.2
Si, max.	0.50	0.50	0.50	0.50	0.50	0.50	4.4.2.2
Mg, max.	0.10	0.10	0.10	0.10	0.10	0.10	4.4.2.2
Zn, max.	0.25	0.25	0.25	0.25	0.25	0.25	4.4.2.2
Other elements, total, max.	1.00	1.00	0.50	0.50	0.50	0.50	4.4.2.2
Nonvolatile matter, min.	99.0	99.5	-	-	-	-	<sup>2</sup>
Easily extracted fatty and oily matter, max.	3.0	1.5	-	-	-	-	<sup>2</sup>

<sup>1</sup>Table is based on a total content of 100%.

<sup>2</sup>Shall be determined in accordance with ASTM D 480.

### 3.2 Form.

3.2.1 Type I. Type I aluminum powder shall be in the form of irregular flat flakes when examined as specified in 4.4.2.1.

3.2.2 Types II and III. Types II and III aluminum powder shall consist of granular particles of nodular or spheroid form when examined as specified in 4.4.2.1.

3.3 Particle size distribution. Types I, II, and III aluminum powder shall conform to the requirements of table III when tested as specified in 4.4.2.3. The powder shall pass through the required sieves readily without balling or the particles clinging together.

TABLE III. Particle distribution.

Classes	Density (g/cm <sup>3</sup> )	Size ranges mesh <sup>1</sup> (μm)	Weight %
1	0.30 max.	+325 mesh (>44) -325 mesh (<44)	1.0 max. 99.0 min.
2	No determination	+325 mesh (>44) -325 mesh (<44)	6.0 max. 94.0 min.
2A	No determination	+100 mesh (>149) -100 to +200 mesh (149 - 74) -200 mesh (<74)	0.2 max. 20.0 max. 80.0 min.
3	0.50 max.	+100 mesh (>149) -100 to +200 mesh (149 - 74) -200 to +325 mesh (74 - 44) -325 mesh (<44)	0.2 max. 15.0 max. 15.0 max. 80.0 min.
4	0.90 min.	+50 mesh (>297) -50 to +100 mesh (297 - 149) -100 to +200 mesh (149 - 74) -200 mesh (<74)	0.0 3.0 max. 3.0 - 20.0 80.0 - 97.0
4A	0.90 min.	+20 mesh (>840) -20 to +100 mesh (840 - 149) -100 to +200 mesh (149 - 74) -200 mesh (<74)	2.0 max. 30.0 max. 65.0 max. 30.0 - 60.0
5	0.90 min.	+12 mesh (>1680) -12 to +30 mesh (1680 - 590) -30 mesh (<590)	0.0 13.0 - 26.0 74.0 - 87.0
5A	0.90 min.	+30 mesh (>590) -30 to +50 mesh (590 - 297) -50 to +140 mesh (297 - 105) -140 mesh (<105)	13.0 - 26.0 35.0 - 45.0 30.0 - 46.0 3.0 max.
6	0.95 to 1.20	+100 mesh (>149) -100 to +200 mesh (149 - 74) -200 to +325 mesh (74 - 44) -325 mesh (<44)	2.0 max. 20.0 max. 10.0 - 35.0 65.0 - 90.0
7	0.95 min.	+40 mesh (>420) -325 mesh (<44)	0.5 max. 25.0 - 50.0
8	0.95 min.	+12 mesh (>1680) -325 mesh (<44)	0.5 max. 35.0 max.

<sup>1</sup>A + sign means particles are larger than the nominal sieve size. A - sign means particles are smaller than the nominal sieve size.

3.4 Apparent density. The apparent density in grams per cubic centimeter shall conform to the requirements of table III when tested as specified in 4.4.2.4.

#### 4. VERIFICATION

4.1 Classification of inspection. The inspection requirements specified herein are classified as conformance inspection (see 4.3).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed on a lot. A lot shall consist of one or more batches (see 6.4) of the aluminum powder of the same type, grade, and class offered for acceptance at one time and produced by one manufacturer, in accordance with the same specification, or same specification revision, under one continuous set of operating conditions. Each lot shall consist of that quantity of aluminum powder that has been subjected to the same unit chemical or physical mixing process intended to make the final product homogeneous. In the event the process is a batch operation, each batch shall be a lot.

4.3 Conformance inspection. Conformance inspection shall be performed in accordance with inspection provisions set forth herein. The characteristics shown in 3.1, 3.2, and 3.3, when tested in accordance with 4.4, shall constitute minimum inspections to be performed by the supplier prior to government acceptance or rejection by lot. Sample containers shall be obtained at random from each lot of aluminum powder in accordance with table IV. When lots exceed 2,500 containers, the sample size shall be calculated using the following equation:

$$n = 0.15\sqrt{N}$$

where: n = sample size

N = lot size

A specimen shall be obtained from each container in the sample and placed in a clean, dry container labeled to identify the lot and the container from which it was taken. Each specimen shall be tested as specified in 4.4. Failure of any test, by any sample, shall be cause for rejection of the lot represented. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the government for acceptance comply with all requirements of the contract.

TABLE IV. Sampling.

Lot size	Sample size
1	1
2 to 275	2
276 to 545	3
546 to 900	4
901 to 1345	5
1346 to 1875	6
1876 to 2500	7

#### 4.4 Test methods.

4.4.1 Component and material inspection. In accordance with 4.3, components and materials shall be inspected in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this specification or applicable purchase document.

4.4.2 Test. Distilled water and analytical reagent grade chemicals shall be used throughout the tests. Where applicable, blank determinations shall be run and corrections applied where significant. Tests shall be conducted as follows:

## MIL-DTL-512C

4.4.2.1 Form. Place a small portion of the sample on a glass slide and examine the material under a 20 to 30 power microscope.

4.4.2.2 Chemical composition. The chemical composition of the aluminum powders shall be determined in accordance with ASTM E 34 or equivalent tests.

4.4.2.3 Particle size distribution. The particle size distribution of class 1 material shall be determined in accordance with ASTM D 480 using a No. 325 (45 $\mu$ m) sieve. For all other classes, the particle size distribution shall be determined in accordance with ASTM B 214. All percentages shall be by weight using sieves conforming to ASTM E 11.

4.4.2.4 Apparent density. The apparent density of classes 1 and 4 material shall be determined in accordance with ASTM B 329. For all other classes, the apparent density shall be determined in accordance with ASTM B 417.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.3). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the inventory control point's packaging activity within the military department or defense agency, or within the military department's system command. Packaging data retrieval is available from the managing military department's or defense agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. Aluminum powder covered by this specification is intended for use as listed in table V.

TABLE V. Intended use.

Type and grade	Intended use
Type I Grade A Grade B	Primer composition Pyrotechnics
Type II Grade C Grade D Grade E	Pyrotechnics Plain incendiary thermite High explosive incendiary projectiles
Type III Grade F Grade F class 7	Heavy explosive Minol and tritonal loaded items

6.1.2 Military unique. Aluminum powder covered by this specification is a technical grade aluminum used in military applications such as pyrotechnics, explosives, and primer. The particle size, moisture content, and other chemical characteristics required herein are significant.

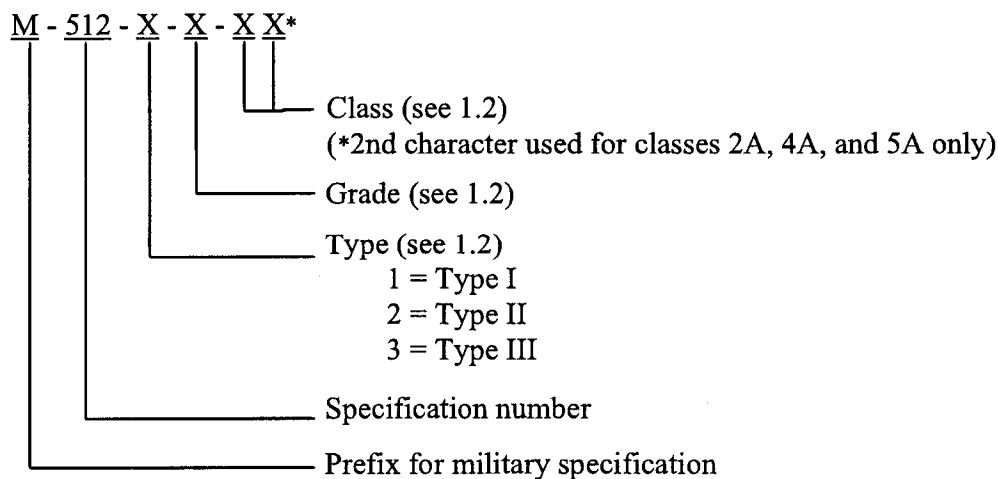
6.2 Material safety data sheets. Contracting officers will identify those activities requiring copies of the completed material safety data sheets (MSDS) prepared in accordance with FED-STD-313. The pertinent government mailing addresses for submission of data are listed in FED-STD-313, and 29 CFR 1910.1200 requires that the MSDS for each hazardous chemical used in an operation must identify the activities requiring copies of the MSDS.

6.3 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of the specification.
- b. Type, grade, and class required (see 1.2).
- c. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).
- d. Packaging requirements (see 5.1).

6.4 Batch. A batch is defined as that quantity of material that has been manufactured by some unit chemical process or subjected to some physical mixing intended to make the final product substantially uniform.

6.5 Part or identifying number (PIN). The PIN to be used for aluminum powder acquired to this specification is created as follows:



6.6 Subject term (key word) listing.

explosives  
incendiaries  
metal  
primer  
propellants  
pyrotechnics

MIL-DTL-512C

6.7 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodian:  
Army - EA

Preparing activity:  
DLA - GS3

Reviewer:  
Army - AR

(Project 6810-1672)



# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
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NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

### I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER  
MIL-DTL-512C

2. DOCUMENT DATE (YYYYMMDD)  
20011203

### 3. DOCUMENT TITLE

ALUMINUM POWDER, FLAKED, GRAINED, AND ATOMIZED

### 4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

### 5. REASON FOR RECOMMENDATION

### 6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)  
(1) Commercial  
(2) DSN  
(if applicable)

7. DATE SUBMITTED  
(YYYYMMDD)

### 8. PREPARING ACTIVITY

a. NAME

Defense Supply Center Richmond

b. TELEPHONE Include Area Code)

Commercial: (804) 279-5019 DSN: 695-5019

c. ADDRESS (Include Zip Code)

ATTN: DSCR-VBD (C. Hammond)  
8000 Jefferson Davis Highway  
Richmond, VA 23297-5610

### IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:

DEFENSE STANDARDIZATION PROGRAM OFFICE (DLSC-LM)  
8725 John J. Kingman Road, Suite 2533  
Fort Belvoir, Virginia 22060-6221  
Commercial: (703) 767-6888 DSN: 427-6888